The Langurs of the Gir Sanctuary (Gujarat)— A preliminary Survey[1]

BY

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(With three plates and two text figures)

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The findings presented here relate to observations made on the social life and allied aspects of langur (*Presbytis entellus*) behaviour at Gir Forest. The investigations were carried out for a period of one month during July/August, 1971. In all 24 troupes were actually encountered though a few more were reported to be present over an area of about 6 square km along the trekkable roads. The majority of these troupes were located in the western Gir where the vegetation was typically riverine with deciduous trees, while only a small number were seen and were reported to exist in the eastern part with its scanty food supply and poor cover. Though a variety of trees exist in eastern part they do not provide enough food for the choosy langurs. Some of the troupes lived near cultivated fields which they sometimes invaded in quest of food.

Out of the 24 troupes encountered, the composition and size of eleven troupes was studied. Of these 9 were bisexual, one an exclusive male troupe, and one a 'male-bisexual' troupe. The average troupe size was 30.44 for the bisexual troupe and 2.0 for the exclusive male troupe. The average male-female ratio in a bisexual troupe was 1:5.28. The linear extent of the home range was between $2\frac{1}{2}$ to 4 km and the troupe size appeared to influence the extent of area covered.

DESCRIPTION OF THE STUDY AREA

The Gir Wild Life Sanctuary is a managed teak and acacia forest. Located in Junagadh district of Gujarat State, about 320 km north-

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west of Bombay and 280 km southwest of Ahmedabad, it is approximately 64 km long by 24 km wide and encompasses about 1255 square km with elevations ranging between 226 m and 648 m above sea level.

The region has three seasons: cool dry from early October to February with minimum temperature reaching 7.2°C; hot dry between February and June with maximum temperatures of 43.3°C; and monsoon from late June to early October with irregular precipitations accounting for most of the annual rainfall of 300-450 mm. Several types of recognisable plant associations have been identified: *open teak forest on red soil*, about 10 m high and the canopy consisting of 70-90 per cent of aged teak. The understory consists of *Carissa carandas* and other dense shrubs along with deciduous shrubs like *Helicteres isora* and thorny species of *Acacia* and *Zizyphus*. Grasses include *Themeda quadrivalvis* and *Sehima nervosum*. *Dense teak forests*, found on gentle slopes with black soil, are close and spread over 60 per cent and are about 15 m high. Other trees are non-thorny and deciduous. A dominant grass is the tall, shade tolerant *Apluda mutica*. *Dense thorn forest* 4-8 m high with an overstory of 70 per cent of *Acacia arabica* occurs commonly on flats or gentle slopes and around nesses. This formation is typically found on rich and black soil with relatively poor drainage. A *dry tropical riverine vegetation* is restricted to both the perennial and intermittent drainages. It is dominated by evergreen species like *Syzygium rubicundum* and *Pongamia glabra* which rises to 25 m; the dense understory consists of evergreen shrubs such as *Carissa carandas* and the ground is covered with shade tolerant grasses like *Oplesmenus burmanii*.

About 8000 maldharis[1] occupy 129 nesses[2] within the sanctuary. Several "forest settlements" or pockets of agriculture, occur within the sanctuary. The forest is an important watershed for much of the surrounding agricultural land. Four miles north of Sasan, Kamleshwar dam impounds the largest man-made lake in Junagadh district.

Equipment and Method of Study

Observations required only a camera, binoculars, compass, field notebook and occasionally a hand drawn map of Sasan Gir locale.

For nearly a month regular trips were made into the forest, especially into those areas that had running streams with riverine vegetation, and the negotiable roads were investigated for the presence of

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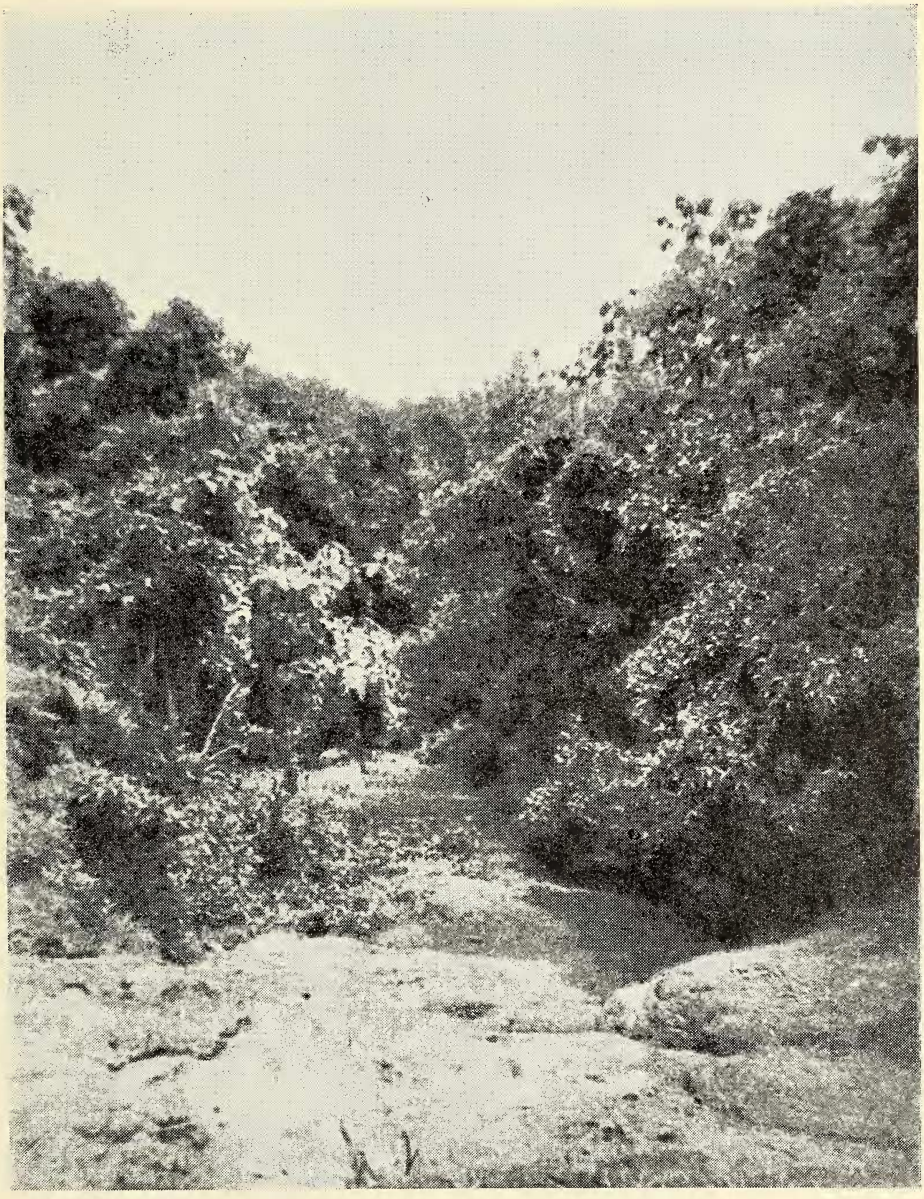
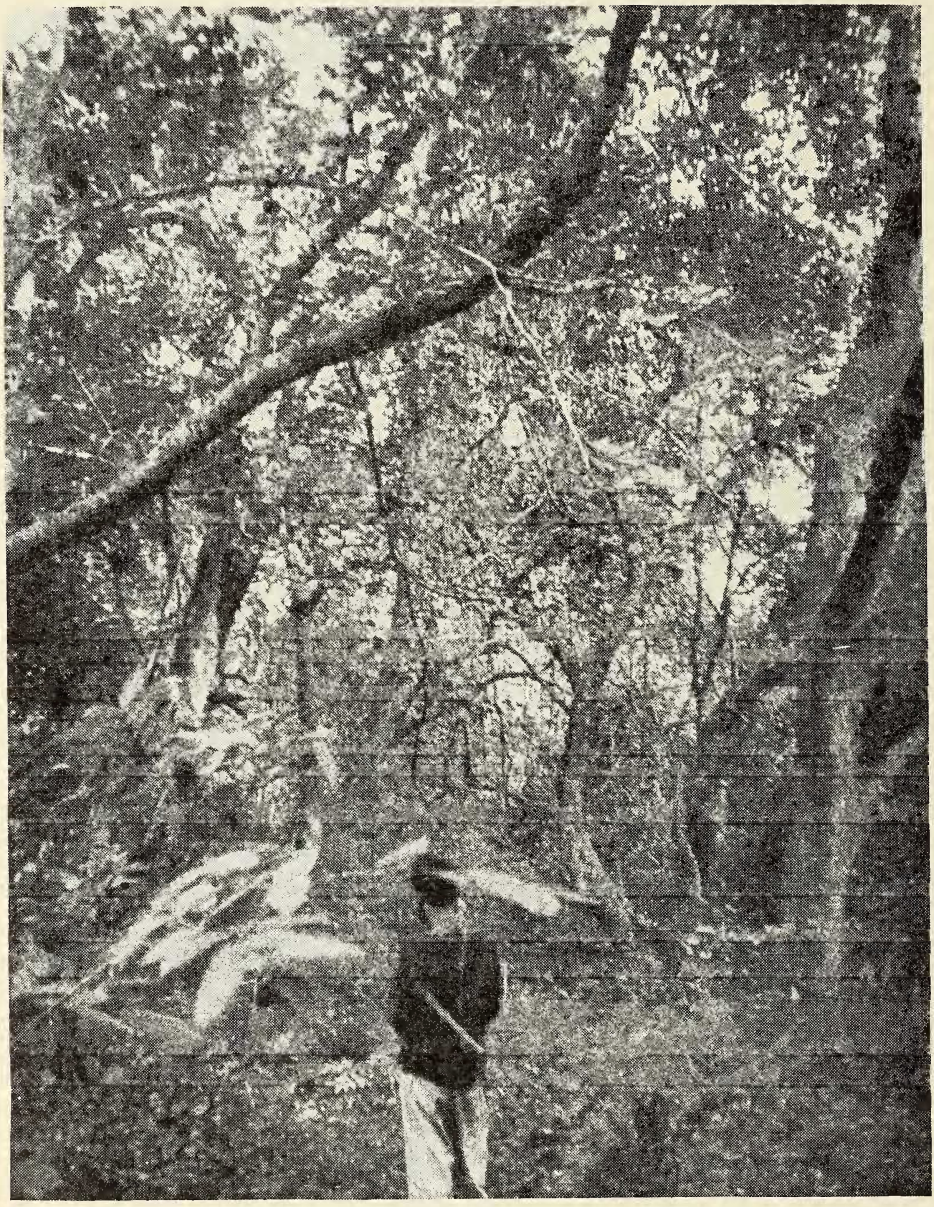
[1] Graziers. [2] Villages.



Typical riverine habitat

(*Photo : Author*)



Overhead canopy formed of entangled branches across a stream

(*Photo : Author*)

monkeys. As the study period was short, the discrimination and identification of a few members from different troupes was not possible. Thus for the study of the population the main interest was focussed upon the size and composition of different troupes, as either or both varied for different troupes. As the vegetation was too dense to permit an easy count of all individuals, the counts were taken as the animals crossed open terrain such as roads or patches of grass or nullahs. Sometimes they were manoeuvered by me into crossing areas where they could be properly counted.

The troupes located near Sasan village were then selected for studies on home range, roosting places, day range, interspecies and intraspecies interactions etc. These two troupes were constantly followed, sometimes with the help of a local guide, from sunrise until the langurs settled down for the night which was sometimes as late as 1930 hrs. The troupes were followed on foot along the dry nullah bed or across the river for about a week.

Observations were recorded briefly and later transcribed and expanded. The movement, feeding, and roosting places were plotted on a hand drawn map. The daily notes included such details as feeding, roosting, social interactions, procession pattern, number of progressions, preferred areas and extent of area covered etc.

The observations recorded were not totally free from bias as they were greatly hindered by the limitation of time and observations during the monsoon at Gir. The time spent in contact with monkeys was short and the animals were visible only for a few hours a day. The animals were difficult to find and were likely to be lost on crossing a river or moving away. They did not become habituated to the author's presence during the short period. It thus took much time to gather a reasonable body of data.

The quality of data gathered was also affected by poor visibility, as many monkeys were screened behind leaves and their activities could not be determined. The observations were sometimes fragmentary as the animals could not be observed from close range as a silent approach was impossible in the thick growth. In any behavioural interaction all the participants were rarely visible and thus the amount of data collected during the month of study was not sufficient for correct interpretation. A long term study covering other seasons would avoid these drawbacks.

Results

Population

During the study period 24 troupes were seen. Although more

monkeys were reported to be present, only those that were actually seen have been marked on the map (fig. 1). Of these 24 troupes, 22 were located in the western and the other 2 in eastern Gir. Apparently the majority lived in western Gir owing to the preferred habitat (riverine) and abundance of food. The scrubby vegetation with acacia and zizyphus of the eastern Gir did not harbour many monkeys. Though, not much time was spent in the quest of monkeys in east, I was advised by the local inhabitants that they were rare. The few rivulets of the eastern Gir and the trees such as *Wrightia, Terminalia* and *Syzygium* associated with them harboured the few langurs that were encountered.

Of the 24 troupes, the size and composition of 11 were analyzed (Table 1). Twenty troupes were bisexual; one exclusively male, and one 'male-bisexual'. Among the bisexual troupes the largest one had 48 individuals (Sasan-fence troupe) while the smallest (Jamwadla and Hiran troupes) had 16. The largest proportion of males to females within a bisexual troupe was 8 males: 11 females in the Chitrode troupe and the smallest was 1 male: 22 females in the Amrutvel troupe. The average bisexual troupe size was 30.44 while the average was 15.1 for Hanuman langur at Dharwar (Sugiyama *et al.* 1965). The average ratio was 1 male: 5.5 females in bisexual troupes. The exclusive male troupe consisted of 3 males and was located about 4 km from Sasan village. The adult member of this troupe was seen attempting to join the Chitrode troupe.

The single male (Sasan station troupe) which for unknown reasons led an isolated existence, visited human dwellings and ate proferred food. This male joined the Sasan fence troupe at will without being resented by others and it is possible that he belonged to that troupe originally but became isolated from them by visits to human habitation. Nevertheless he was sometimes away from the troupe and completely cut off from it for as long as a couple of days leading a solitary life and hence treated as a separate male-bisexual troupe. No solitary langur was seen in the Dharwar area (Parthasarathy, personal communication).

Home range and roosting places

The daily movement of two selected troupes (Sasan fence and Sasan hiran) was studied over a ten day period to determine the extent of home range, number of roosting places and the core areas etc. The Sasan fence troupe had its home range running along the nullah and stretching roughly between Chodia road to the north and Visavdar road to the south. The area covered was roughly 4 km (fig. 2).

The Sasan hiran troupe made excursions over an area of about $2\frac{1}{2}$ km along the Hiran river bank, more often along its northern bank.

Fig. 1. Location of the 24 troupes at Gir.

1 to 11 are the troupes whose size had composition was studied. a to m are the ones whose size and composition could not be studied.

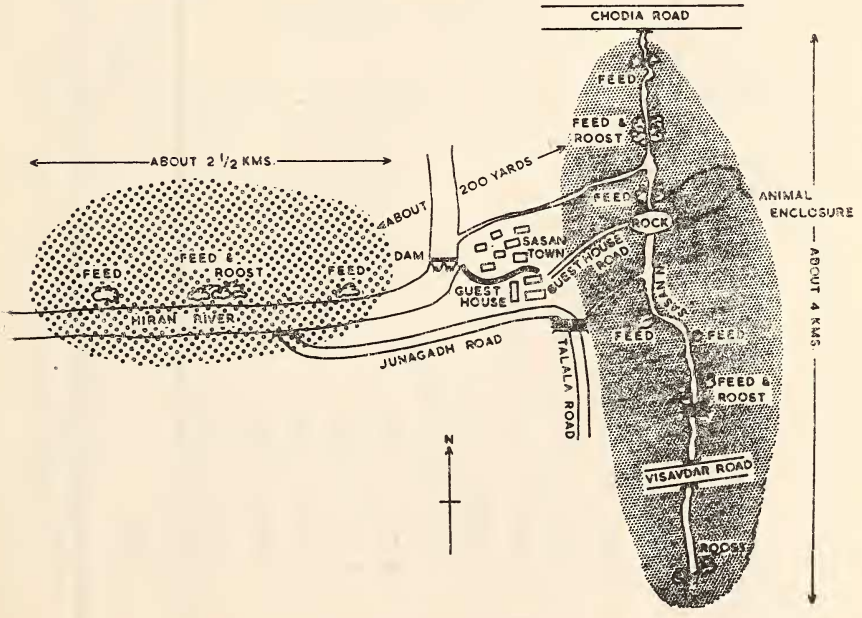


Fig. 2. Home range of the troupes.

Sasan-fence troupe is represented by small dots and Hiran troupe by larger ones.

TABLE 1

COMPOSITION OF THE TROUPES STUDIED AT GIR

Sl. No.	Name of the troupe	Adult males	Subadult males	Adult females	Subadult females	Juveniles	Babies	Total	Comments
1	Pilipat Troupe	2	2	27	3	1	3	38	Bisexual
2	Sasan Gir fence troupe	3	1	10	19	9	6	48	Bisexual
3	Sasan Gir Hiran troupe	1	—	8	3	2	2	16	Bisexual
4	Sasan Gir Station troupe	1	—	—	—	—	—	1	Male|Bisexual
5	Chitrode troupe	6	1+1*	9	2	1	3	23	Bisexual
6	Talala Road troupe	1	1	10	—	2	4	18	Bisexual
7	Karanya troupe	1	2	—	—	—	—	3	Male troupe
8	Kapuria troupe	2	4	15	6	9	5	41	Bisexual
9	Amrutvel troupe	1	?	20	2	3	4	30	Bisexual
10	Shirvan troupe	3	1	23	8	2	6	43	Bisexual
11	Jamwadla troupe	1	—	3	1	8	3	16	Bisexual
	Total	22	13	125	44	37	36	277	
		35		169		37	36	277	

1 * One subadult male killed and eaten by dogs.

Rahaman : Langurs

Left : The solitary male (station) individual visiting human dwellings. *Right :* The solitary male grinds his teeth on the approach of a dog

(*Photos : Author*)

The langurs that lived on riverine vegetation spent only 10 per cent of their time on the ground while the ones in more open habitat (Talala road) spent as much as 30-40 per cent time on the ground. The former fed on tree tops while the latter spent much of their time on the ground searching for worms and pupae that formed a major part of their diet.

It was difficult to make out specific core areas unlike the langur at Dharwar (Sugiyama *et al.* 1965) as they had the habit of spreading out over a wide area. The feeding areas however, appeared to serve the function of core areas as well, where the langurs spent a considerable amount of time. This observation is further strengthened by the fact that though suitable feeding trees are present all along the length of the home range, only a few selected ones are usually visited by the langurs.

Morning activities (0600 to 0700 hrs) on a bright sunny day and in the evening between 1700 to 1800 hrs were quick. They left the roost in the morning for feeding and usually covered the whole extent of the home range. There was no clear pattern of troupe movement. The subadult females in many cases led the procession and, rarely, the dominant male who usually whooped before leaving the sleeping quarters.

The home ranges of the two troupes studied did not overlap at any point and there was an actual gap of about 200 yards between them made by Hiran river. It was therefore not possible to study interaction between these troupes. However langur at Gir did move within clearly demarcated boundaries. This was illustrated by the behaviour of the Sasan station solitary male who sometimes joined the Sasan fence troupe. This male had the habit of threatening and chasing moving jeeps. He had a specific area within which he was found and he chased vehieles only up to a certain point and then returned. He was never seen chasing any vehicle beyond that point as if he was satisfied with seeing the vehicle off his range.

The Talala road troupe that was studied for 5 days again appeared to keep clear of the boundary of Chitrode and Karanya troupes. It seemed probable that the overlapping of home ranges studied elsewhere for other primates was mainly due to pressure on available space.

However the Karanya troupe sometimes did invade the home range of Chitrode troupe but this did not indicate an overlap in true sense as the former was an all-male troupe and had no fixed range. All-male troupes have been noted not to observe strict territoriality (Sugiyama *et al.* 1965).

As the extent of range was not studied during different seasons of the year, especially summer, it was difficult to record whether the

range remained unaltered throughout. Starin (personal communication) stated that there was no marked difference in the extent of area covered by Jamwadla troupes between summer and monsoon. Bonnet macaques are known to move over long distances, sometimes even beyond the confines of home range, if food is insufficient and more so during summer. If the contrary was true for the Gir langurs it would suggest:

(a) that food was uniformly available during different seasons, either in the form of leaves, fruits or flowers as the vegetation along a stream or river was not dependant upon rains.

(b) that the langurs continued to roam about over the whole extent of the home range even during the monsoon irrespective of the availability of food.

The troupe between Asundrali and Odi Ness in the eastern part, confined its movements to a small area along the Kogham stream. It roamed over an area of about $2\frac{1}{2}$ to 3 km, but stopped about $\frac{1}{2}$ km short of Odi Ness, though the vegetation was similar and extended as far as Odi Ness itself. This indicates that the langurs did not exploit a larger area than necessary and that the area between its home range and Odi Ness was too small for another troupe to occupy. It is probable that the langurs, atleast those in eastern Gir, extend their range in summer as the food becomes scanty when the nullahs dry up.

The dominant male and sometimes adult females watched from tree tops. If vision was obstructed by branches, they were parted and held apart. While on the ground, two langurs often sat back to back, as if to watch in opposite directions. The topmost branches were normally occupied by vigilant males and mothers with infants, the middle part of the canopy by adult females and subadult males and the lower part by juveniles. The vigilant individuals warned others of any approaching danger by giving out a whoop or alarm bark. Two males of Karanya troupe invariably watched while the third fed in cultivated fields.

The whoop sounded very much like the call of the crow pheasant (*Centropus sinensis*) and was given out by the adult male in various contexts. The earliest whoop was heard at 0600 hrs and the last at about 1920 hrs before retiring. The animal may call once or more. The maximum number heard was 9 whoops within 3 minutes. The Chitrode troupe whooped on spotting the Karanya troupe. The whoop may accompany the bark of alarm on detecting danger such as a panther. Whoops were given out from tree tops but never from the ground. In many cases a deep whoop resulted in an involuntary agitation of the branch which could be related to branch shaking noticed among other primates. The whoop accompanying the bark of alarm indicated panic and sounded like *ahoon, ahoon, eh, eh; ahoon, ahoon, eh; ahoon,*

ahoon, eh, eh, and so on and the animals in this state urinated and defecated. *Ghrr, Ghrr....* by the dominant male announced the passing of danger. A whoop with or without the accompaniment of teeth grinding announced dislike and threat and was directed at less dominant individuals or the observer. The teeth grinding sounded very much like the croaking and was emitted by opening the jaws with a snap and then closing slowly and was sometimes directed at dogs also. The juveniles gave out a squeal which might mean dislike or fear as directed at the observer, but they were silent on seeing a panther. The squeal was very similar to that given out by a bonnet baby that was left alone. A soft squeal given out by juveniles to the more dominant individuals indicated their desire to groom.

Langurs did not have a single roosting place, but a number of selected tall trees served the purpose. Sometimes they slept on the feeding trees. The Sasan-fence troupe slept mainly on a ficus tree to the north of the Railway bridge and sometimes on a *Terminalia* clump to the south of Chodia road. On two occasions the troupe was seen roosting on tall teak trees to the south of Visavdar road.

While the Hiran river troupe was seen roosting on Tamarind and *Syzygium* trees, the Talala road troupe slept consistently on a ficus tree, the only large tree located in that area of low teak and cultivated fields. The Kapuria troupe was seen roosting on a very tall *Holoptelea* tree next to the Forest quarters on two consecutive nights.

It was not uncommon for the troupe to spread over four to five trees and sleep. The Talala road troupe on one occasion split up into two parties and slept in two different places. One party of two females with infants and two juveniles led by a subadult male slept on the usual ficus tree, while the rest (Table 1, for composition) led by the dominant male slept on a *Soymida* tree about $1\frac{1}{2}$ km from the ficus, but well within the home range. The next morning the parties reunited.

The troupes living in thick forest areas with riverine vegetation settled down for the night's rest around 1800 hrs while the ones in the more open areas continued to spend time on the ground sometimes until as late as 1915 hrs. Before retiring the dominant male would whoop or yawn. There was no definite pattern in the act of climbing a tree by members of different status or sex. After having settled down, some individuals displayed a vocalisation like teeth grinding but lower in pitch, whose significance could not be determined as it was given out in darkness; possibly it served to establish relative positions.

Thick horizontal branches were selected to lie down. The animals, either individually or in groups of two or more, huddled together or lay with their limbs and tails dangling. Sometimes a fork with one horizontal and another vertical branch was selected and the animal sat on the horizontal branch and embraced the vertical one; sometimes

the head was also placed on the latter. To prevent the baby from slipping and falling at night, the mother while sitting in a fork, raised her legs about half as high as her body height and placed them on the vertical branch. The baby was thus held between the horizontal branch below and the mother's legs on either side. The mother in this position might rest her head on the baby's head and sleep. Some individuals rested their heads on their drawn up knees. The baby either sat close to its mother or clung to her. On waking, the langurs bared their teeth and jerked their heads forwards and backwards and again settled down to sleep. This act of teeth baring and head nodding was used in the same context as lip smacking among bonnets but might or might not be directed at any other individual (3). At night their eyes reflect red in a beam of light.

On a cloudy day they were still dozing on tree tops around 900 hrs, but on a sunny morning they were up and moving about by 600 hrs. While leaving the roosting place the dominant male might whoop. If they slept on a feeding tree, on waking up the next morning they moved on to the end of a branch and started to feed. The mother might nurse her infant a little before starting to feed.

Day Ranges

For the study of day ranges the activities of langurs were recorded from the time they left the roosting place till they settled down in another. Four major activities were recorded as in other primates.

(a) Movement

Langurs left the roosting places for feeding during the early hours of morning and vice versa during evening. On reaching a feeding tree, if the food was a preferred one like *Terminalia* or *Tamarindus,* they spent hours without visiting other food trees. Heavy showers sometimes impeded their movement. During group movement it was common for any monkey to move in any one direction and sit for a while before moving ahead and another individual very often came to the same spot and sat there before the former moved further on. This was continued till the whole troupe moved away. It appeared that owing to their habit of spreading out over wider areas than bonnets, this mode of progression, like a relay race, ensured that all the members of a troupe moved in one particular direction. A similar mode was often resorted to during tree progression too.

Some individuals, juveniles and mothers with young babies, avoided long leaps. Sometimes the baby playfully took the lead and the

mother followed it, to be in turn followed by others, but this happened only on the ground. During movement, the one in the lead made way for the next individual by moving away, irrespective of age, sex or status. At times a part of the troupe remained behind in one core area while the other moved on to another. During progression all the individuals including young ones held their tails curled over their backs with the tip facing forwards and downwards. This physical pose was different from that of Dharwar langurs whose tails arched back with the tips facing down and to the rear. About 50 per cent of the area was covered by running during ground progressions. Sometimes they waded through water across streams.

(b) Feeding

The morning and evening hours were spent in vigorous feeding. The langurs fed on the leaves, fruits and flowers of a variety of trees and climbers (Table 2). The young ones were observed eating bark and tendrils. They ate pupae found on leaves. Usually tender leaves were selected but in the case of large leaves like those of *Wrightia,* the blades were stripped free of the mid rib and eaten while the latter was discarded. Likewise compound leaves such as of *Tamarindus* were stripped from the stalk. One or both hands were used in feeding. At times a slender branch was brought closer and held with one of the hind limbs while the leaves were released with fore limbs. If afraid of the observer, they would squat on a top branch, lean down stealthily to take a quick handful of leaves and went back to the old position and ate there. Long fruits like those of *Wrightia* were plucked and held in the hand and eaten candy-like, with short bites. Fruits of *Terminalia* were most preferred. They wasted a considerable amount of fruits but not leaves. Sometimes pupae were released from the leaves and then put into the mouth, or the mouth was applied directly to them. Once eggs of nesting birds were seen being eaten. On one occasion a female was noticed carefully watching a *Phalangium* on a Sterculia tree, but did not eat it.

As many as 4-5 individuals of different sex and status sat very close to one another and fed indicating the absence of competition for food. Sometimes they spent hours together in uninterrupted feeding. Though feeding might commence with dawn it reached a peak around 1000 hrs and again in the evening around 1700 hrs. During light showers the langurs continued to feed but heavy rain interrupted this activity. Even during the monsoon about 80 per cent of the langurs were seen drinking hence water consumption should be much more frequent in summer. This is contrary to what is reported for langurs elsewhere (Jay 1965). The water was taken by the mouth and the ani-

TABLE 2

LIST OF TREES AND CREEPERS ON WHICH LANGURS FED

Sl. No.	Local name	Scientific name	Part eaten
1.	Saajad*	*Terminalia crenulata*	Fruits and leaves
2.	Timbroo*	*Diospyros melanoxylon*	Fruits and leaves
3.	Doodhlo*	*Wrightia tinctoria*	Fruits and leaves
4.	Karapti	*Garuga pinnata*	Leaves
5.	Ambli*	*Tamarindus indica*	Fruits and leaves
6.	Ambra*	*Emblica officinalis*	Fruits and leaves
7.	Shisam	*Dalbergia latifolia*	Leaves
8.	Bawal	*Acacia arabica*	Flowers and leaves
9.	Jamboo*	*Syzygium rubicundum*	Fruits and leaves
10.	Kalukda	*Holarrhena antidysenterica*	Leaves
11.	Karamdi*	*Carissa carandas*	Leaves
12.	Behda	*Terminalia bellerica*	Leaves
13.	Vadlo*	*Ficus bengalensis*	Fruits
14.	Limbda	*Azardirachta indica*	Leaves
15.	Sarasda	*Albizzia odoratissima*	Leaves
16.	Saral	*Holoptelea integrifolia*	Leaves
17.	Ujad	?	Leaves and flowers
18.	Ron (Rohan)	*Soymida febrifuga*	Leaves
19.	Rhangari	*Morinda tinctoria*	Leaves and flowers
20.	Phangada	?	Leaves
21.	Kanthar	*Zizyphus* sp.	Leaves and flowers
22.	Saag	*Tectona grandis*	Pupae found on leaves
23.	Umbra*	*Ficus glomerata*	Fruits
24.	Ravano	*Syzygium cuminii*	Leaves
25.	Bel pathr*	*Aegle marmelos*	Fruits
26.	Kalum	*Mitragyna parvifolia*	Leaves
27.	Karung*	*Derris pinnata*	Fruits and leaves
28.	Kheria*	*Acacia catechu*	Leaves
29.	Kalukdo	*Holarrhena* sp.	Leaves
30.	Kadaya	*Sterculia urens*	Bark is rarely eaten
31.	Malvelo	*Combretum decandrum*	Leaves and flowers
32.	Dhamanah	*Grewia tiliaefolia*	Leaves
33.	Phagdovelo	Genus? Leguminosae	Leaves
34.	Gondovelo	*Vitis* sp.	Leaves
35.	Malkankana	*Celastrus paniculata*	Leaves
36.	Phankovelo	*Argyreia* sp.	Leaves
37.	Santovelo*	*Abrus precatorius*	Leaves
38.	Fagvel	*Rivea hypocrateriformis*	Leaves
39.	Phalli (Moong)	*Arachis hypogea* †	Leaves and flowers
40.	Bajra*	*Pennisetum typhodeum* †	Fruits
41.	Boona	*Gossypium* sp. †	Leaves

Note. * in fruit during the study period.
† Cultivated.

mal drank for about half minute. Sometimes the young baby from its clinging position lowered its head and lapped water.

(c) Social Grooming

A characteristic tactile stimulation that serves many purposes in primate society is grooming (Marler 1965). As in the case of bonnets there appeared to be considerable variation in the grooming frequency depending upon the time of day, reaching a peak when the sun was at its zenith. The grooming was indulged in when other individuals were inactively relaxing or dozing. For the purpose of grooming two or more individuals gathered and groomed one another. Sometimes there was self grooming as well. The mother groomed her infant and vice versa, a juvenile groomed another or a subadult or an adult. The grooming could thus occur in any one of the combinations irrespective of sex, age or status. The grooming was either of short duration, as in the case of a subadult grooming another or when grooming occurred on the ground. But it was of a considerably longer duration when a mother groomed her infant or an adult female groomed an adult male. The groomed animal might sit or lie down or doze while being groomed and shifted position exposing the desired parts to be groomed or the grooming animal itself fixed the position by pushing or pulling by the limb or neck or ear. The groomer very carefully scanned the area for dust particles and the like and on spotting one, picked it up by hand or put the mouth to it.

The desire to be groomed was expressed by an individual approaching another and making soft noises (*koon..koon..*) or by approaching and/or reaching out and holding a passerby by its limb or back. The latter invariably groomed the former. Sometimes the expression of this desire became more complex in dealing with an uncooperative partner. An adult female held a subadult female to be groomed. The latter skipped over the former and sat a few feet away. The adult female followed her and sat down close to her with her right leg resting on the latter's back. Once again the latter moved a short distance away, but the adult female persistently followed her and on reaching her gave her a gentle pat on her back. The subadult female turned and faced the adult female and was immediately embraced by her. The subadult female settled down to groom the adult female.

Sometimes the juveniles approached adult individuals and expressed their desire to groom by giving out a squeal but keeping a short distance away from them. They faced the animal that they wanted to groom and leaned forward squealing. If the latter expressed the desire to be groomed by exposing chest or loin, the juveniles immediately closed the distance and started to groom, but if the latter bared its teeth they backed away still squealing.

While grooming her infant, the mother held it pressed tightly against her, then stretched out a limb and groomed it. The baby might rest its head on the mother's lap and doze a bit while being groomed. Even if there were no parasites or dust, as indicated by the groomer not picking up and eating them, the mother continued to groom her infant for long periods. Mothers with young infants groomed more frequently than others and this might be due to reduced activity and movement by them.

The groomed animal sometimes stood upright on all fours and was groomed in the hind quarters. At times an open palm was passed over the body to part hair and occasionally both hands were used. The groomed animal to expose the chest and armpit and yet save strain on the hands, raised them and gripped an overhead branch. The tail being long and flexible was held in one hand while it was groomed with the other. The groomer probed even eyes and nose. Babies sometimes groomed their mothers and the female langur groomed more than the male. There were fewer grooming frequencies among langurs than bonnets and out of 51 instances of grooming observed, 23 occurred on the ground and the rest on trees. Many instances of self grooming and scratching were also observed. To scratch the region above the chest they generally used hind limbs and to scratch the region below the chest they used the forelimbs.

(d) Social Play

Social play was indulged in mostly by babies and juveniles. For the purpose, two or more individuals asssociated and were sometimes joined by subadults and adults. Play was either very brief or prolonged based upon the activity of other individuals of the troupe and other interferences. The peak period of social play coincided with the peak period of resting and social grooming by adults.

Play comprised a complex of whirling, jumping, chasing, somersaulting and swinging on slender branches etc. Play should be more important for a langur baby than for a bonnet as the former is more arboreal and taken less care of by its mother. Thus accommodating to its mode of life should depend more on itself and its activity than on any other agency or individual. It was obvious that even 3-4 month old babies, as determined by coat colour, could very easily negotiate vertical branches. The juveniles and babies spent more time in active play, feeding and moving than in dozing or grooming.

Hierarchy

Though a clearcut hierarchy was not observed, some individuals

did behave in a more dominant manner than others. This was especially so with adult males and mothers with infants. An adult male at close approach of the observer came down to a lower branch and ground teeth while others sought shelter higher. On detecting danger or while leading the troupe the dominant male whooped and barked. Whenever there was a quarrel or a sudden and loud snapping of branch, it was the dominant male that rushed to the site. When the troupe was running on the ground and away from the observer it was he who ran last and resented the approach of the observer.

Likewise a mother with young infant expressed her dominance over others, especially the juveniles that harassed her infant, and successfully chased them away.

Even among juveniles some males appeared to be more dominant than others in that they were consistently watchful and it was these individuals that approached the observer as close as 20 yards and gave out squeals of resentment from a tree top. The squeal was given out by an individual that slouched forward, bared teeth and made trilling sounds accompanied by tail vibrations. On hearing such squeals some individuals approached closer to investigate the cause.

Troupe organisation was loose and lacked cohesiveness as they spread out over very wide areas while feeding or sleeping, with few(er) interactions between members. Hanuman langurs neither exhibit a strict functional ranking order nor a differentiation in their social organisation (Sugiyama & Parthasarathy 1969). But the fact that there were not many intertroupe fights and friction indicated the presence of a hierarchial system that minimised such encounters. But more observations are necessary on this aspect.

Mating and maternal behaviour

Mating behaviour and other social interactions were studied when the langurs were in the open. Langurs display sexual dimorphism in their physical build, males being very much bigger than the females. A total of nine mountings was witnessed during the study period. In eight of the nine copulations observed, the adult male initiated the mount as among bonnets (Simonds 1965) and on no occasion was a subadult male seen either mounting or even attempting. Only once was a female seen offering herself by shaking not only her tail as reported by Jay (1965) for common langurs of north India, but also the rump, and she was immediately mounted by the male. Once a male ground his teeth at an unwilling female, who after brief surrender dislodged the mounted male by lowering her hind quarters and running short distance. She was chased by him, but again she ran a short distance. The male ground his teeth and chased her again at

which she surrendered herself and they copulated. Usually a female after being copulated approached some other individual and expressed her desire to be groomed.

Occasionally the copulation was interrupted by another female. On seeing the adult male mount an adult female, another adult female approached the pair and squealed bringing her snout close to that of the mounted female at which the latter lowered her hind quarters and forcibly dismounted the male. The females then ran away together.

None of the mounts observed were preceded by testing. The female held her tail awkwardly pushed between the legs of the male during copulation, while in the bonnet it was arched over the back and well out of the males' way. There was no instance of masturbation by langurs of either sex as in the case of Japanese monkeys of Taishaku-kyo (Imanishi 1957), in this aspect they differed from the howlers (Altman 1959) and bonnets (Rahaman & Parthasarathy 1968).

When the study was continued in July/August, most of the females had 4-6 month old babies that must have been born around January/March. The peak period of births in langurs was from December to March (Sugiyama *et al.* 1965). Only one female in advanced stage of pregnancy was seen. Thus the langurs at Gir too had a peak period for breeding and the period more or less coincided with those for bonnets (Rahaman & Parthasarathy 1969) and rhesus (Southwick *et al.* 1965). This indicated two important features: (1) essential uniformity of the environmental factors in these three places (North, South and West) control the onset of mating and consequently births among these primates. (2) that these animals gave birth to infants during the period that enabled weaning to coincide with the monsoon season. Weaning during monsoon appears to have two advantages for the baby:– (a) it provides enough food in the form of tender leaves, flowers and a few fruits, (b) it ensures safety as it is during this period that the young one is left more to itself by its mother and is safer in the thick canopy of leaves than otherwise.

Young babies appeared darker in colour than the older ones. The dark babies usually clung to their mothers and suckled or slept holding the teat in their mouth. Mothers with such babies were inactive and spent less time feeding but more in resting and nursing the baby on top branches well concealed behind leaves. They usually avoided the close approach of the observer. At times small babies were left behind on trees when the mother moved away for food. On such occasions the babies screeched and tried to follow, but on failing to keep pace settled down to await their return. When she moved from one place to another, the mother carried the baby clinging to her belly and no instance of riding by the infants was witnessed. While progress-